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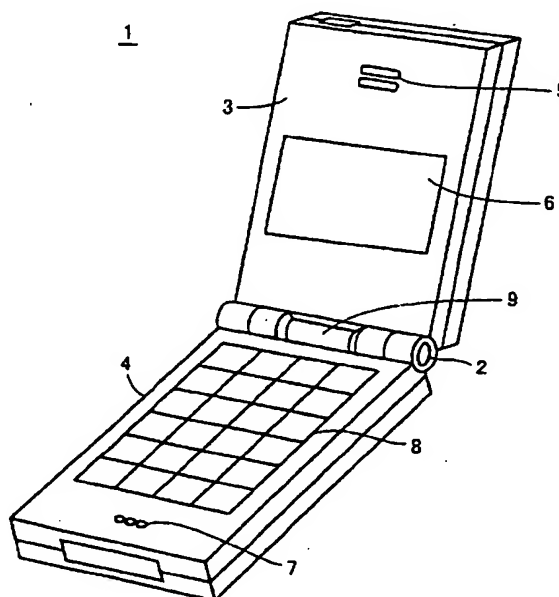
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(54) **Foldable portable telephone using one of the shieldings as a second antenna**

(57) In a foldable portable telephone (1), a shield box (14) provided within an upper casing (3) is connected via a flexible cable (9) to an output terminal of a transmitting circuit (15) provided within a lower casing (4), and the shield box (14) is used as an antenna. Thus, compared to the conventional case where a rod antenna is provided at an upper end of the lower casing (4), variation in gain dependent on a state of the user's hand holding the portable telephone is lessened.

FIG. 1



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is considerably larger than the conventional rod antenna 40, variation in gain dependent on a state of the user's hand holding portable telephone 1 is lessened than in the conventional case, so that stable signal transmission/reception is enabled.

[0026] Hereinafter, various kinds of variations of this embodiment will be described with reference to Figs. 5-13. In the variation shown in Fig. 5, a rod antenna 16 is further provided to the embodiment shown in Fig. 4. Rod antenna 16 is mounted to lower casing 4, and its base end (a feeding portion) is connected to the output terminal of transmitting circuit 15. In this case, rod antenna 16 is used in addition to shield box 14 serving as the antenna, and thus, high gain is obtained. Accordingly, the variation in gain dependent on a state of the user's hand holding portable telephone 1 is further lessened than in the conventional case.

[0027] In the variation shown in Fig. 6, again, rod antenna 16 is further provided to the embodiment of Fig. 4. In this variation, however, rod antenna 16 is mounted to upper casing 3, and its base end is connected to an upper end of shield box 14. In this case, shield box 14 is used as the antenna and also as a power transmission line, and rod antenna 16 is also utilized. Accordingly, high gain is obtained, and the variation in gain dependent on a state of the user's hand is alleviated.

[0028] In the variation shown in Fig. 7, transmitting circuit 15 and others are provided on the upper casing 3 side, while liquid crystal panel 6 and others are provided on the lower casing 4 side. It is configured such that the user holds upper casing 3 when talking on the phone. The ground terminal of transmitting circuit 15 is connected to ground layer 10b of multilayer substrate 10, and the output terminal of transmitting circuit 15 is connected via flexible cable 9 to shield box 14'. In this case, again, the variation in gain dependent on a state of the user's hand is alleviated.

[0029] In the variation shown in Fig. 8, shield box 14 of the embodiment of Fig. 4 is replaced with a shield box 17. Shield box 17 is provided with a slit 17a to cause the antenna current to detour. By adjusting the shape and dimensions of slit 17a, it is possible to optimize the characteristics of shield box 17 as an antenna.

[0030] In the variation shown in Fig. 9, shield box 17 of the variation in Fig. 8 is replaced with a shield box 18. Shield box 18 is provided with a fin 18a at its end portion for adjustment of a length of the current path. Adjusting the shape and dimensions of fin 18a enables the characteristics of shield box 18 as an antenna to be optimized.

[0031] In the variation shown in Fig. 10, a matching circuit 20 is interposed between flexible cable 9 and shield box 14 of the embodiment shown in Fig. 4. In this case, it is possible to minimize a reflection level and input impedance of a signal in shield box 14, and thus, efficient signal transmission/reception is enabled. Alternatively, matching circuit 20 may be interposed between the output terminal of transmitting circuit 15 and flexible

cable 9.

[0032] In the variation shown in Fig. 11, a matching circuit 21 is interposed between the base end of rod antenna 16 and shield box 14 of the variation shown in Fig. 6. In this case, a reflection level and input impedance of a signal in rod antenna 16 can be minimized, so that efficient signal transmission/reception is enabled. Matching circuit 21 may be interposed between flexible cable 9 and shield box 14, or between flexible cable 9 and the output terminal of transmitting circuit 15.

[0033] The variation shown in Fig. 12 is the case where a matching circuit 22, a switch 23 and a sensor 24 are added to the variation shown in Fig. 10. Switch 23 has an output terminal 23c that is connected via flexible cable 9 to the output terminal of transmitting circuit 15, one switching terminal 23a that is connected via matching circuit 20 to shield box 14, and the other switching terminal 23b that is connected via matching circuit 22 to shield box 14. Matching circuit 20 is configured to minimize a reflection level and input impedance of a signal in shield box 14 in the state where the portable telephone is unfolded. Matching circuit 22 is configured to minimize the reflection level and input impedance of the signal in shield box 14 in the state where the portable telephone is folded. Sensor 24 detects whether the portable telephone is folded, and outputs a signal of an H level when it is unfolded, and outputs a signal of an L level when it is folded.

[0034] When the portable telephone is unfolded, the signal of an H level output from sensor 24 causes terminals 23c and 23a of switch 23 to conduct. Thus, the output terminal of transmitting circuit 15 is connected via flexible cable 9, switch 23 and matching circuit 20 to shield box 14.

[0035] When the portable telephone is folded, the signal of an L level output from sensor 24 causes terminals 23c and 23b of switch 23 to conduct. Thus, the output terminal of transmitting circuit 15 is connected via flexible cable 9, switch 23 and matching circuit 22 to shield box 14. Accordingly, regardless of whether the portable telephone is folded or not, the input impedance and reflection level of the signal in shield box 14 can be minimized, and thus, efficient signal transmission/reception is enabled.

[0036] The variation shown in Fig. 13 is the case where a switch 25 and a sensor 26 are added to the variation shown in Fig. 5. Switch 25 has a common terminal 25c connected to the output terminal of transmitting circuit 15, one switching terminal 25a connected to the base end of rod antenna 16, and the other switching terminal 25b connected via flexible cable 9 to shield box 14. Sensor 26 detects whether the user's hand is touching rod antenna 16. When the hand is not touching the antenna, sensor 26 outputs a signal of an H level. If the hand is touching the antenna, it outputs a signal of an L level.

[0037] When the user's hand holding the portable telephone is not touching rod antenna 16, the signal of an

H level output from sensor 26 causes terminals 25c and 25a of switch 25 to conduct, and the output terminal of transmitting circuit 15 is connected via switch 25 to rod antenna 16.

[0038] When the user's hand is touching rod antenna 16, the signal of an L level output from sensor 26 causes terminals 25c and 25b of switch 25 to conduct, so that the output terminal of transmitting circuit 15 is connected via switch 25 and flexible cable 9 to shield box 14. Accordingly, regardless of whether the hand of a user holding the portable telephone is touching rod antenna 16 or not, high gain can be obtained, so that stable signal transmission/reception is enabled.

[0039] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.

Claims

1. A foldable portable telephone having first and second casings (4, 3) coupled with each other via a hinge portion (2), comprising:
 - first and second electronic circuit portions (10', 15; 10-13) provided within said first and second casings (4, 3), respectively; and
 - first and second shield members (14', 14) for shielding said first and second electronic circuit portions (10', 15; 10-13), respectively, at least one of said first and second shield members (14', 14) additionally serving as an antenna for said portable telephone.
2. The portable telephone according to claim 1, wherein said first electronic circuit portion (10', 15) includes a communication circuit (15) for communicating with a base station using said second shield member (14) as the antenna.
3. The portable telephone according to claim 2, wherein said second shield member (17) includes a slit (17a) for adjusting its characteristics as the antenna.
4. The portable telephone according to claim 2, wherein said second shield member (18) includes an extended portion (18a) for adjusting its characteristics as the antenna.
5. The portable telephone according to claim 2, further comprising an antenna matching circuit (20) connected between said communication circuit (15) and said second shield member (14).
6. The portable telephone according to claim 2, further comprising:
 - a first antenna matching circuit (20) for matching when said portable telephone is unfolded;
 - a second antenna matching circuit (22) for matching when said portable telephone is folded;
 - a detector (24) for detecting whether said portable telephone is folded; and
 - a switching circuit (23) operating based on a detected result of said detector (24), for connecting said first antenna matching circuit (20) between said communication circuit (15) and said second shield member (14) when said portable telephone is unfolded, and for connecting said second antenna matching circuit (22) between said communication circuit (15) and said second shield member (14) when said portable telephone is folded.
7. The portable telephone according to claim 2, further comprising an antenna (16) mounted to said first casing (4) and having its feeding portion connected to said communication circuit (15),
 - said communication circuit (15) communicating with said base station via said second shield member (14) and said antenna (16).
8. The portable telephone according to claim 2, further comprising an antenna (16) mounted to said second casing (3) and having its feeding portion connected to said second shield member (14),
 - said communication circuit (15) communicating with said base station via said second shield member (14) and said antenna (16).
9. The portable telephone according to claim 8, further comprising a matching circuit (21) for said antenna (16) that is connected between said second shield member (14) and the feeding portion of said antenna (16).
10. The portable telephone according to claim 2, further comprising:
 - an antenna (16) mounted to said first casing (4);
 - a detector (26) for detecting whether a hand of a user of said portable telephone is touching said antenna (16); and
 - a switching circuit (25) operating based on a detected result of said detector (26), for connecting said communication circuit (15) to said antenna (16) when said user's hand is not touching said antenna (16), and for connecting said communication circuit (15) to said second shield member (14) when said user's hand is touching said antenna (16).

said communication circuit (15) communicating with said base station via either one of said antenna (16) and said second shield member (14) that is connected to said communication circuit (15) by said switching circuit (25).

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FIG. 1

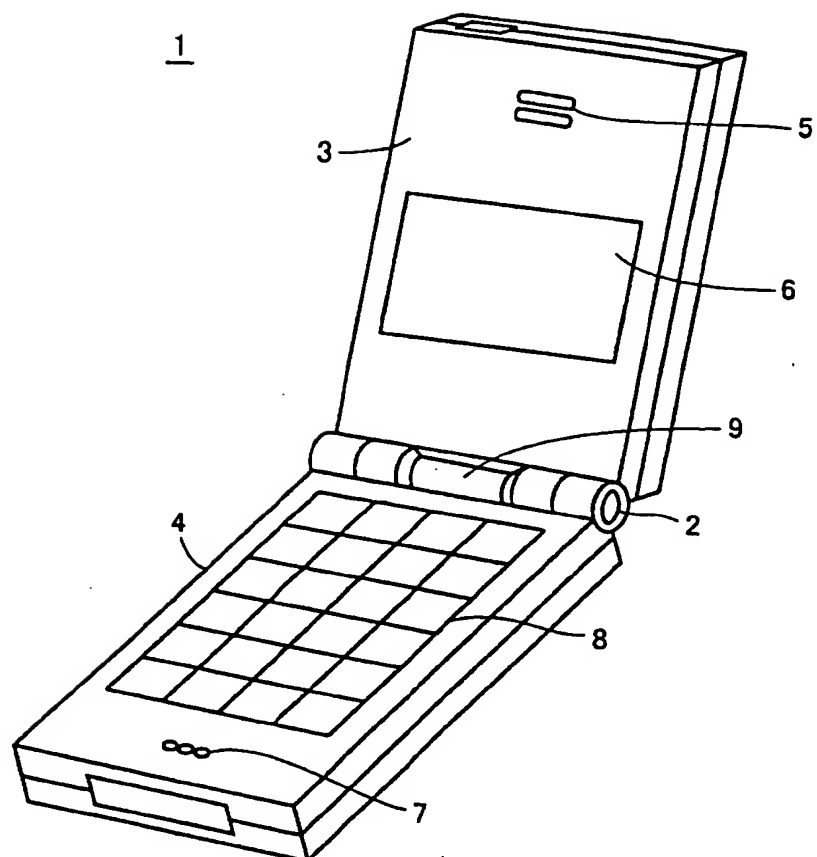


FIG. 2

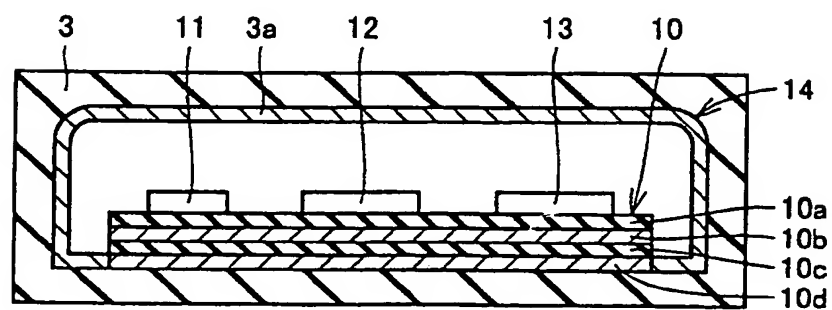


FIG. 3

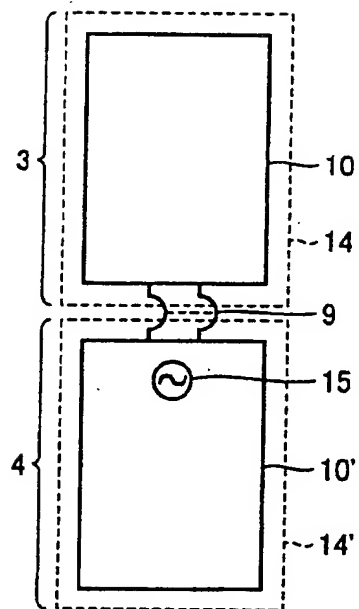


FIG. 4

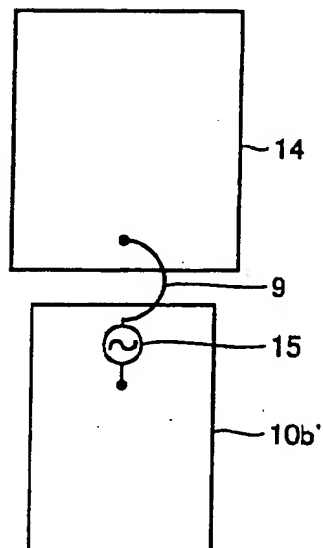


FIG. 5

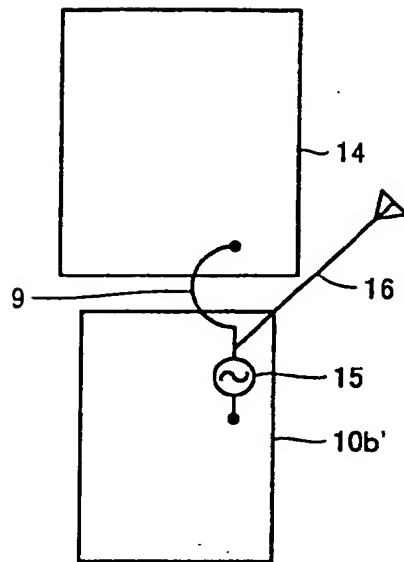


FIG. 6

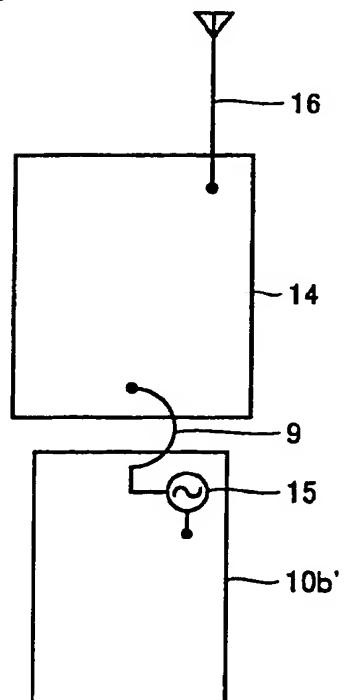


FIG. 7

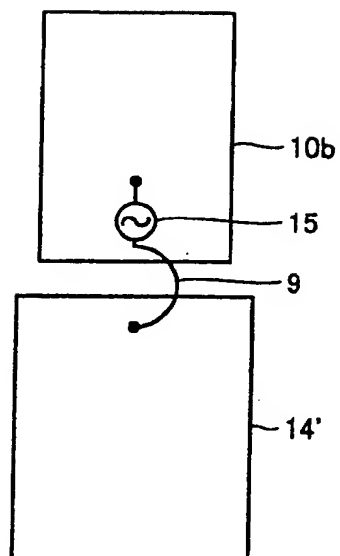


FIG. 8

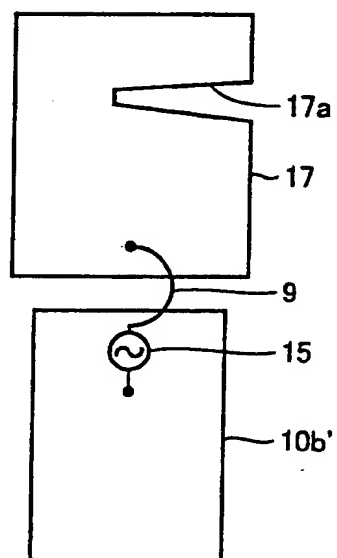


FIG. 9

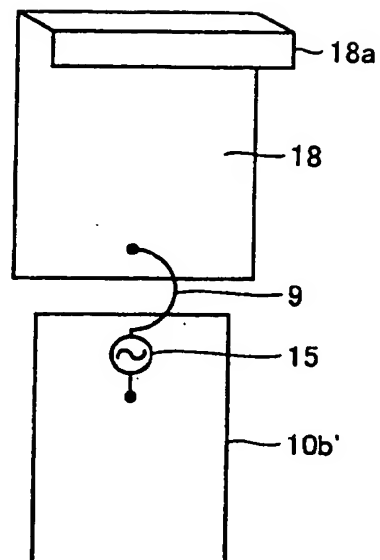


FIG. 10

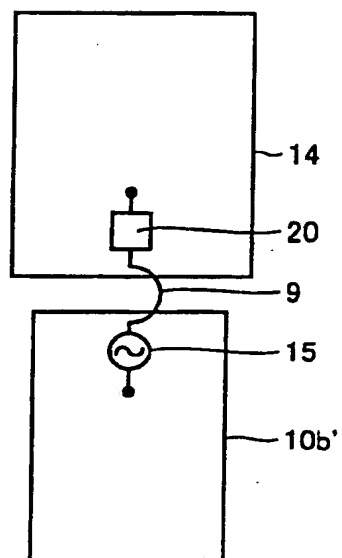


FIG. 11

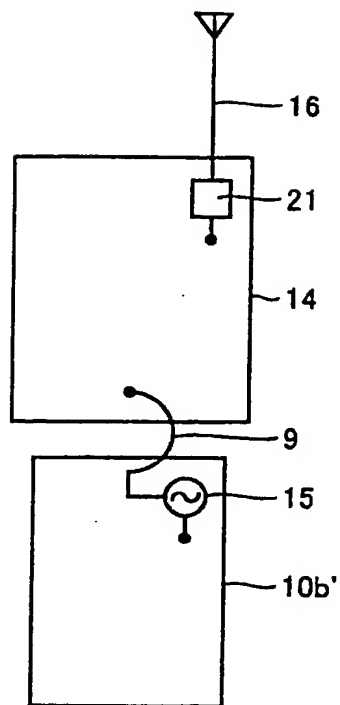


FIG. 12

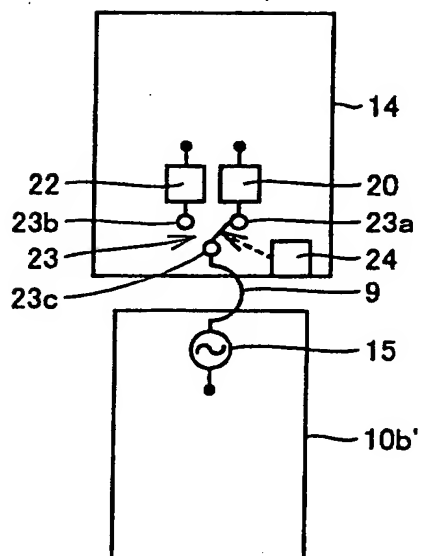


FIG. 13

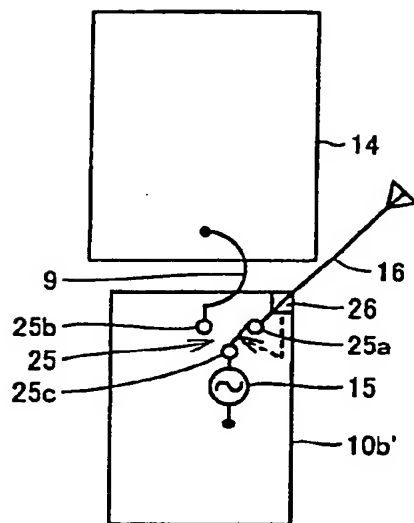
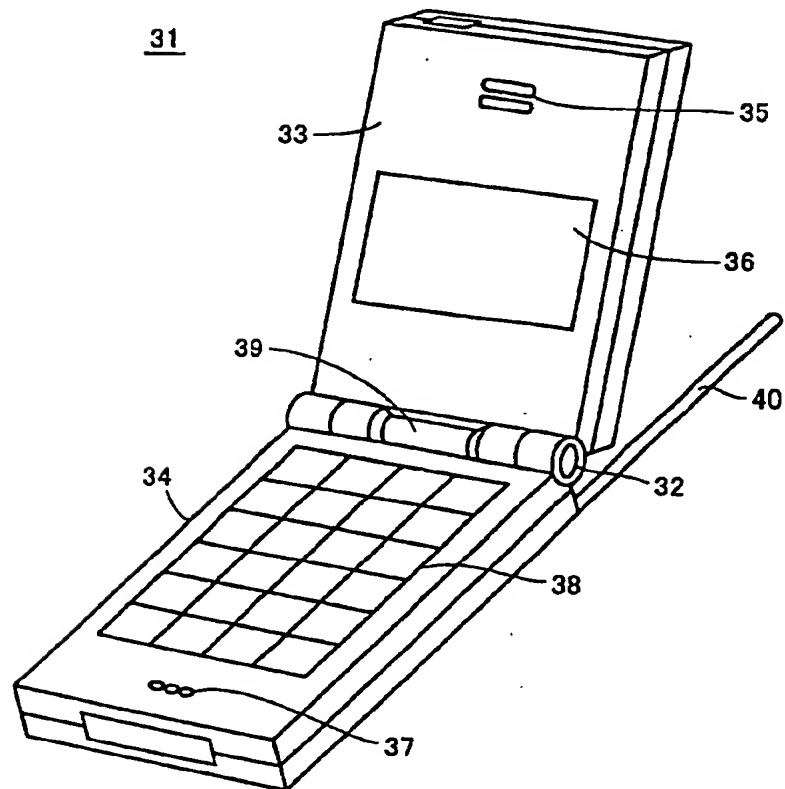


FIG. 14





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Application Number
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 10 July 2002	Examiner Marinov, I
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EP FORM 1503 03.02 (P04001)

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